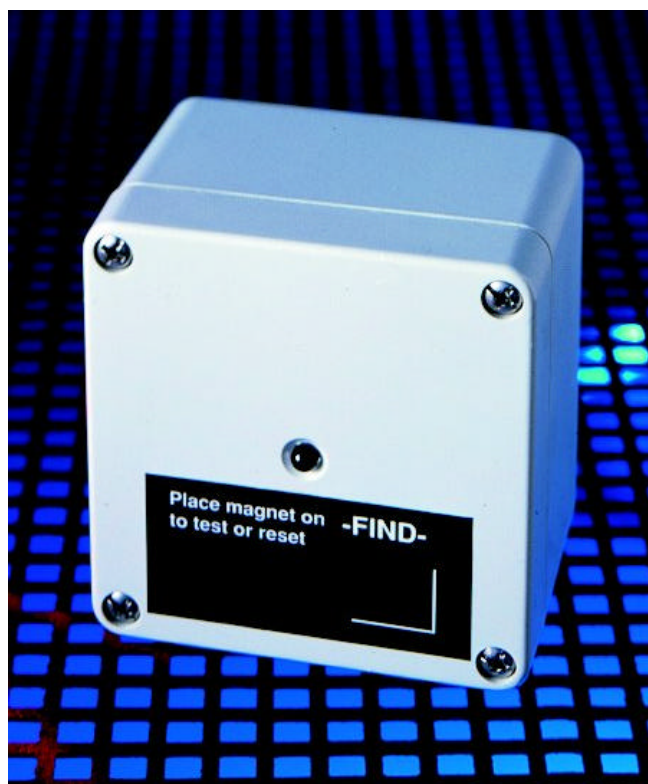


FIND

Electronic Earth Fault Indicator



USER MANUAL

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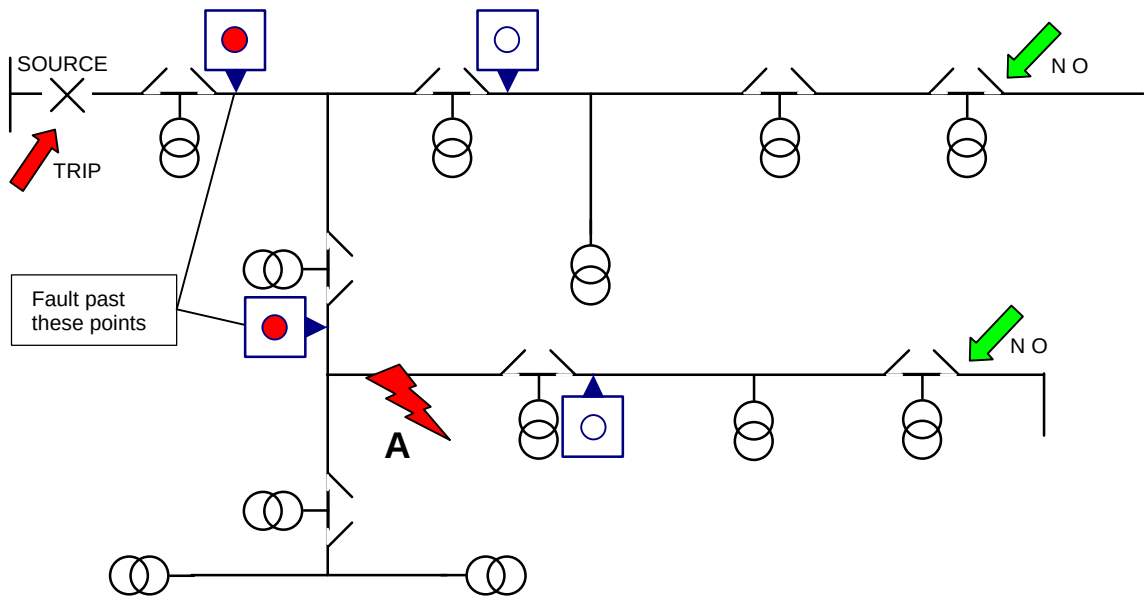
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Contents

<i>section</i>	<i>page</i>
1. PRODUCT BACKGROUND	2
2. OPERATION	3
overview	
principle of operation	
characteristics	
physical description	
operating curve	
micro processor	
3. SPECIFICATION	6
earth fault sensitivity	
indication	
remote indication	
test feature	
reset features	
power supply	
installation	
construction	
sundries	
4. TESTING	8
EMC approval	
short circuit tests	
5. INSTALLATION	9
Positioning CT on cable	
FIND wiring connections	
FIND with internal solid core CT	
Split Core CT installation	
6. ORDERING INFORMATION	13

1. PRODUCT BACKGROUND

When protection equipment trip circuit breakers during fault conditions reliable information regarding the fault location can reduce the time off supply experienced by electricity consumers. The use of FIND indicators on underground cable distribution networks enables electricity utility engineers to quickly and accurately determine which section of the underground system is responsible for the interruption to consumer supplies. The faulty section can then be isolated and supplies to healthy sections of network restored.



2. OPERATION

2.1 OVERVIEW

The FIND has been developed to detect, at a point on the 11kV underground network, the passage of earth fault current. The unit is self powered and operates by the application of a small voltage derived from a current transformer at the time of a through fault. An indication of through fault is given by a flashing hyper bright LED for a pre-set time period. On completion of the time period the unit will self reset and is then ready to detect subsequent through faults. The FIND may also be manually reset or automatically reset on the restoration of supply.

2.2 PRINCIPLE OF OPERATION

The device is triggered by the current produced from the secondary winding of a 60/1 ratio core balance CT mounted around the power cable. The minimum trigger level has been set to be above the likely maximum level of zero sequence capacitive current under severe out of zone earth-fault conditions.

Care has been taken to ensure that stray magnetic fluxes do not cause inadvertent operation or premature resetting of the device.

An internal lithium battery then powers a processor which is arranged to reset the device after a preset time delay, typically 3 hours, depending on the requirement.

During the delay period the LED flashes to indicate the passage of fault current. FINDs between the source CB and the fault will flash, FINDs beyond the fault will not operate.

On completion of the timing period the unit self resets and is ready to detect any subsequent through faults. The device may be prematurely reset manually by applying a small magnet over the word 'FIND' on the front of the unit for approximately 5 seconds. Where specified the optional electrical reset operates approximately 0.5 seconds after the 12/24/48V DC Telecontrol signal is applied or approximately after 10 seconds after the 50/110/240V AC mains supply is restored.

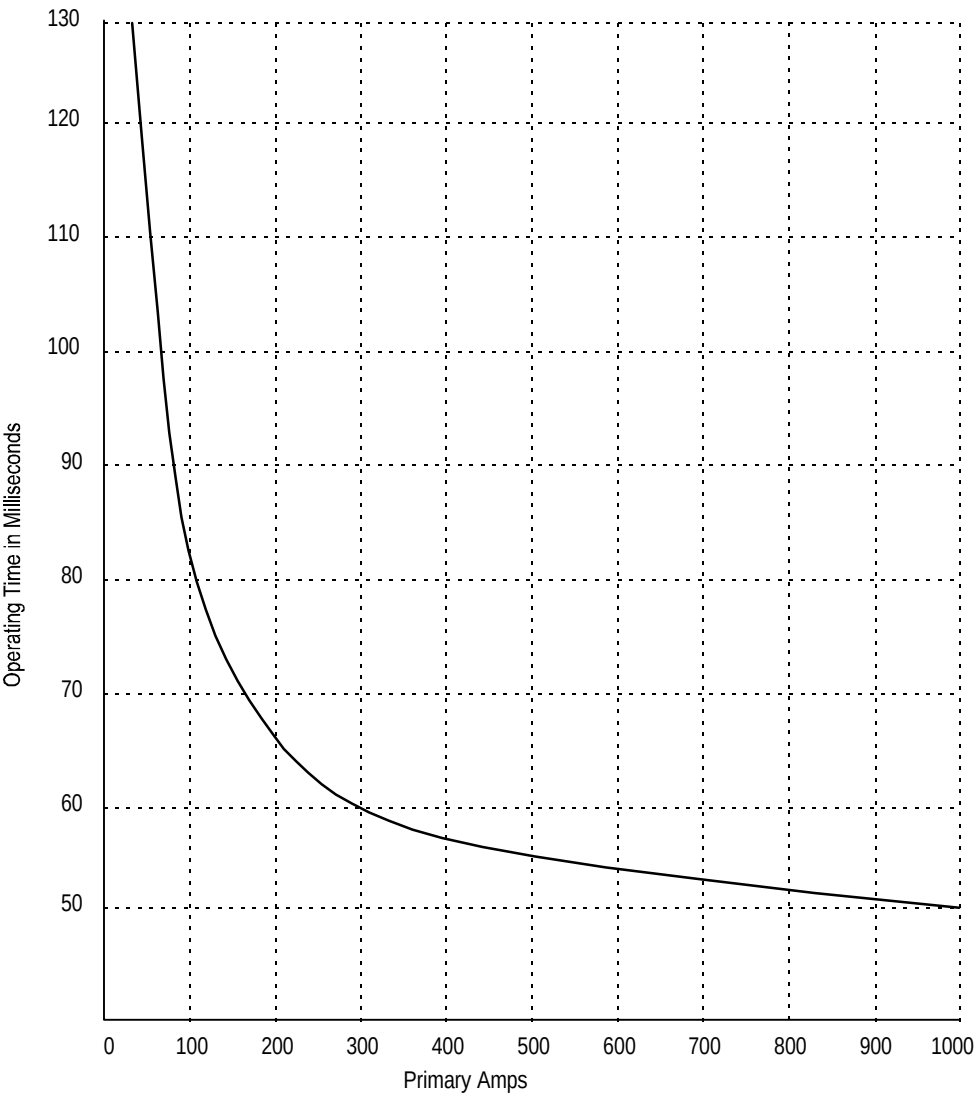
2.3 OPERATING CHARACTERISTICS

A Block Diagram is shown on the page 4, the operating curve is shown on the next page.

2.4 PHYSICAL DESCRIPTION

The indicator is supplied in a robust case, the internal circuitry being solid state and epoxy resin encapsulated for environmental protection. Leads and/or terminals are provided for connection to the current transformer, a remote alarm or system automation scheme and a reset signal (when an electrical reset feature is specified). Local indication is provided by means of a hyper-bright light emitting diode (LED). The units back-plate is used to mount the device in the chosen position either on the switchgear, the substation wall or directly on a core balance CT. Installation onto an existing CT is simple and inexpensive.

2.5 FIND OPERATING CURVE



2.6 MICRO PROCESSOR CONTROL

A new feature introduced in 1996 to the FIND range is micro-processor control. The micro-processor E-PROM replaces the timer counter used in FINDs up to this date. All FINDs supplied from June 1997 will incorporate the micro-processor feature.

The micro-processor controlled FIND has the following benefits compared to the standard FIND:

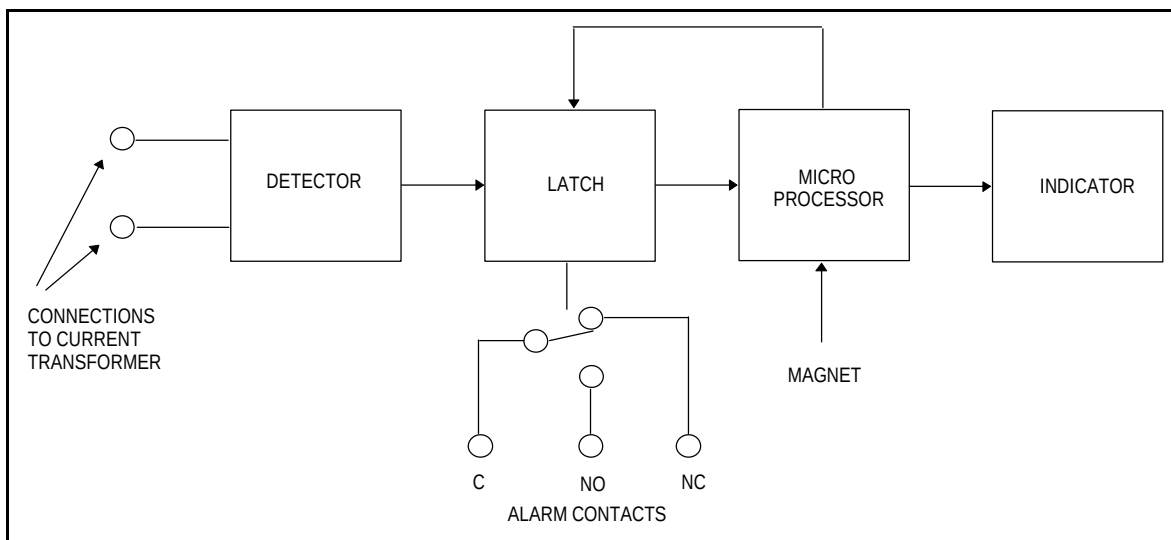
The microprocessor allows the FIND to be tailored to exact customer needs without the delay of hardware modifications, testing and recalibration.

Varying reset characteristics; the mains AC reset time is normally 10 seconds providing immunity from unsuccessful reclosures. The DC telecontrol reset is normally 0.5 seconds to allow for the usual 1 second pulse from telecontrol systems. Self-reset can now be programmed to such short periods thus providing a short alarm pulse for telecontrol systems.

Improved battery test/reset facility. When the test magnet is applied the micro-processor is programmed to give a fast flashing rate during the battery test period. After a few seconds it changes to a steady continuous indication drawing maximum current from the battery thus proving the battery is healthy or otherwise. If the FIND has operated and is already flashing then the faster flashing rate when the magnet is applied shows the unit is functioning correctly and when indication changes to a steady flash it shows that the unit has reset correctly.

Examples where the micro-processor has been exploited to give enhanced performance for specific customer needs include the following:

- Extended LED indication periods of up to 24 hours allowing field staff longer to reach sites during storm conditions. In order to preserve battery life the flash rate decreases after 6 hours from once every 1.5 seconds to once every 10 seconds.
- Very short reset times where the FIND is used exclusively with automation sequences.
- Programming of the output contacts to reset for different criteria from the LED.



3. SPECIFICATION

3.1 Earth Fault Sensitivity

Set to operate between 30 and 60 Amps primary current with a 60/1 core balanced CT at 1.5VA. The device has a short initial time delay of approximately 50 ms.

3.2 Indication

As standard the Hyper bright LED flashes at a rate depending on the indication period specified. The actual flash duration is 200ms. The typical flash rates for any given indication period are as listed below. It is possible to specify any flash rate / duration combination - please specify at time of ordering.

Indication Period	Flash Rate
2 hours	0.9 seconds
3 hours	1.3 seconds (standard)
4 hours	1.8 seconds
5 hours	2.2 seconds
6 hours	2.6 seconds

3.3 Remote Indication

The alarm/system automation contacts (changeover) are electrically separate from the internal circuitry and remain in the operated position for the duration of the indication period or until the unit is reset manually or electrically.

3.4 Test Feature

A battery test feature is provided by applying a small magnet over the word FIND on the front of the unit. This causes the LED to flash. The alarm/system automation relay contacts are not activated during this test.

If the battery is healthy the LED will flash, if battery volts are low the LED will remain on. In the event of a fault and low battery volts the LED will remain on for the duration of the indication period.

3.5 Reset Features

1. Self reset after the specified indication period.
2. Manual reset by applying a magnet for more than 5 seconds.
3. Automatic electrical reset (optional) on the application of a DC supply of 12/24/48V for 0.5 seconds or an AC supply of 50/110/240V for more than 10 seconds. The type of electrical reset must be specified at time of ordering.

3.6 Power Supply

Lithium Thionyl Chloride battery or equivalent providing sufficient energy for at least 150 three hour operations during the estimated 10 year life of the battery. The battery is set in a silicon compound which may be cut away for battery replacement if necessary.

3.7 Installation

The FIND is attached via a CT to RMU's on the incoming or out going 11kV feeder. The indicator can be supplied mounted direct on the front of the CT or separate with a termination box on the CT for applications where remote mounting of the indicator is required.

More details on the installation of the FIND and solid and split CTs are given later in the document.

3.8 Construction

The case is made of a strong durable plastic approximately 80mm x 80mm x 55mm deep, the cover having 4 stainless steel screws which are outside the perimeter of the oil and water tight neoprene gasket seal. The indicating LED is semi recessed for mechanical protection and offers a 180 degree viewing angle.

3.9 Sundries

The FIND is supplied with flying leads for the CT connections and a terminal strip for the remote contacts and voltage reset as standard although any combination of the two can be provided on request. Pre-drilled fixing holes can be provided to suit particular requirements.

4. TESTING

4.1 *EMC Approval*

The FIND has been tested and is compliant with IEC255-22-3 Class3. A copy of the Approval Certificate is attached at the end of this document.

4.2 *Short Circuit Tests*

The FIND has been tested in the short circuit testing laboratory at a major UK switchgear manufacturer.

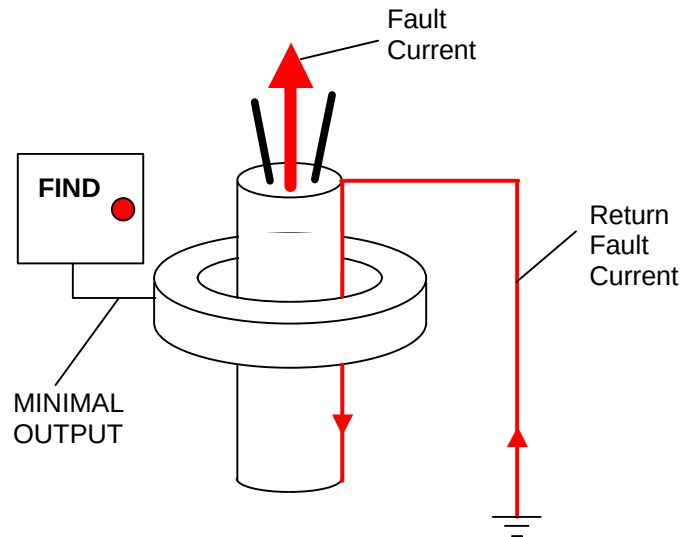
The unit was connected via a 60/1 ratio, 5VA solid core ring CT to an 11kV cable. The indicator and CT combination was subjected to several short circuit test shots up to 13.1kA.

Both indicator and CT withstood these shots without damage. No change in normal operating current was detected after the tests.

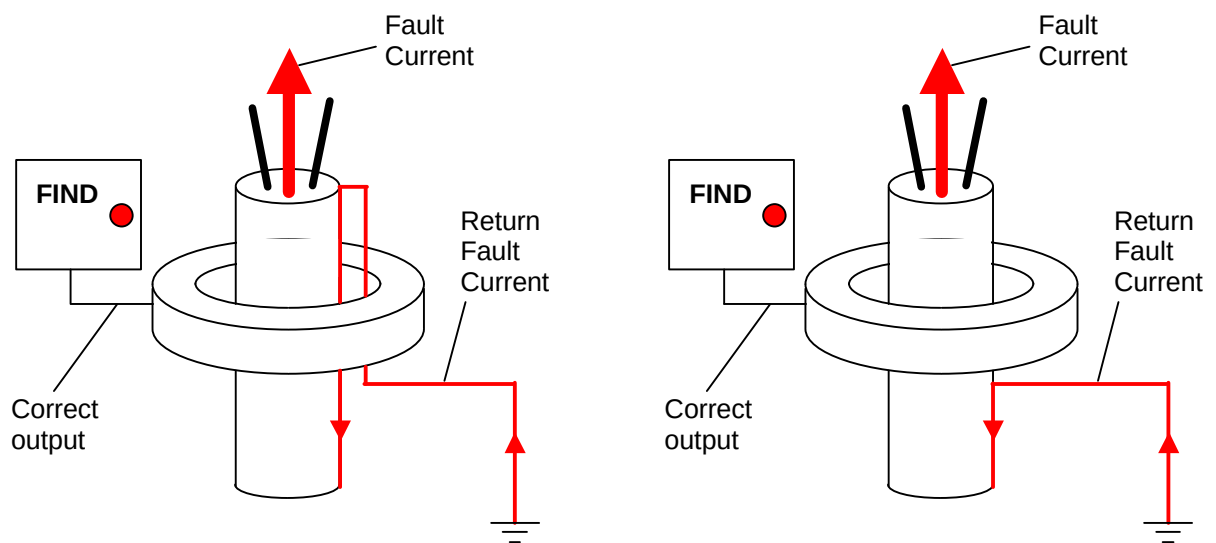
5. INSTALLATION

5.1 Positioning the CT on the cable

Earth fault current is returned to source through the path of least resistance. When the fault occurs in a cable system, the majority of return current will flow through the cable sheath, thus resulting in a null output from a core balance CT, as shown below.



This effect can be prevented if the cable earthing connection between the cable and adjacent switch is routed through the core balance CT as shown below.

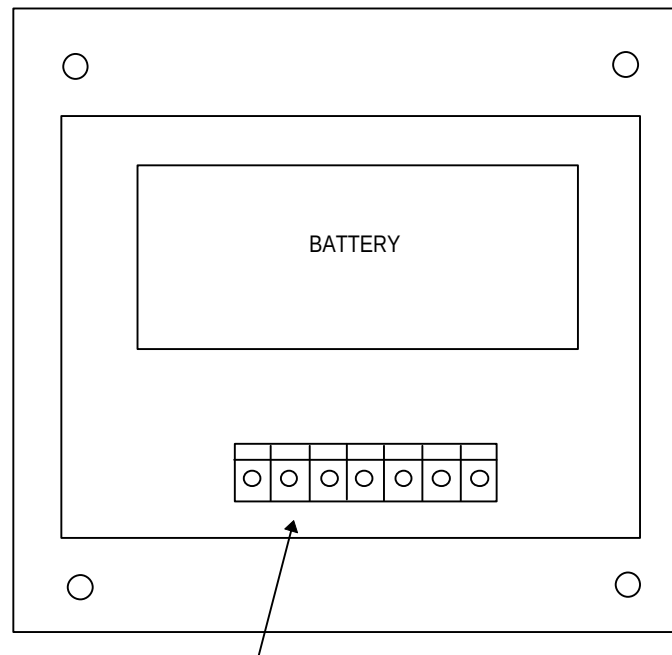


5.2 FIND wiring connections

The FIND may be connected to a suitably approved 60/1 CT for use with EEFIs. Check with the CT manufacturer for suitability of purpose prior to installation. If in doubt contact Nortech for advice.

The diagram below shows the wiring connections

FIND - TERMINAL ARRANGEMENT



CONNECTIONS LEFT TO RIGHT
VIEWED FROM REAR BELOW BATTERY

- left - ALARM NORMALLY OPEN
- ALARM NORMALLY CLOSED
- ALARM COMMON
- CURRENT TRANSFORMER
- CURRENT TRANSFORMER
- OPTIONAL - (NEGATIVE FOR DC RESET)
- right - OPTIONAL - (POSITIVE FOR DC RESET)

5.3 FIND supplied with solid core CT

The FIND is delivered already assembled.

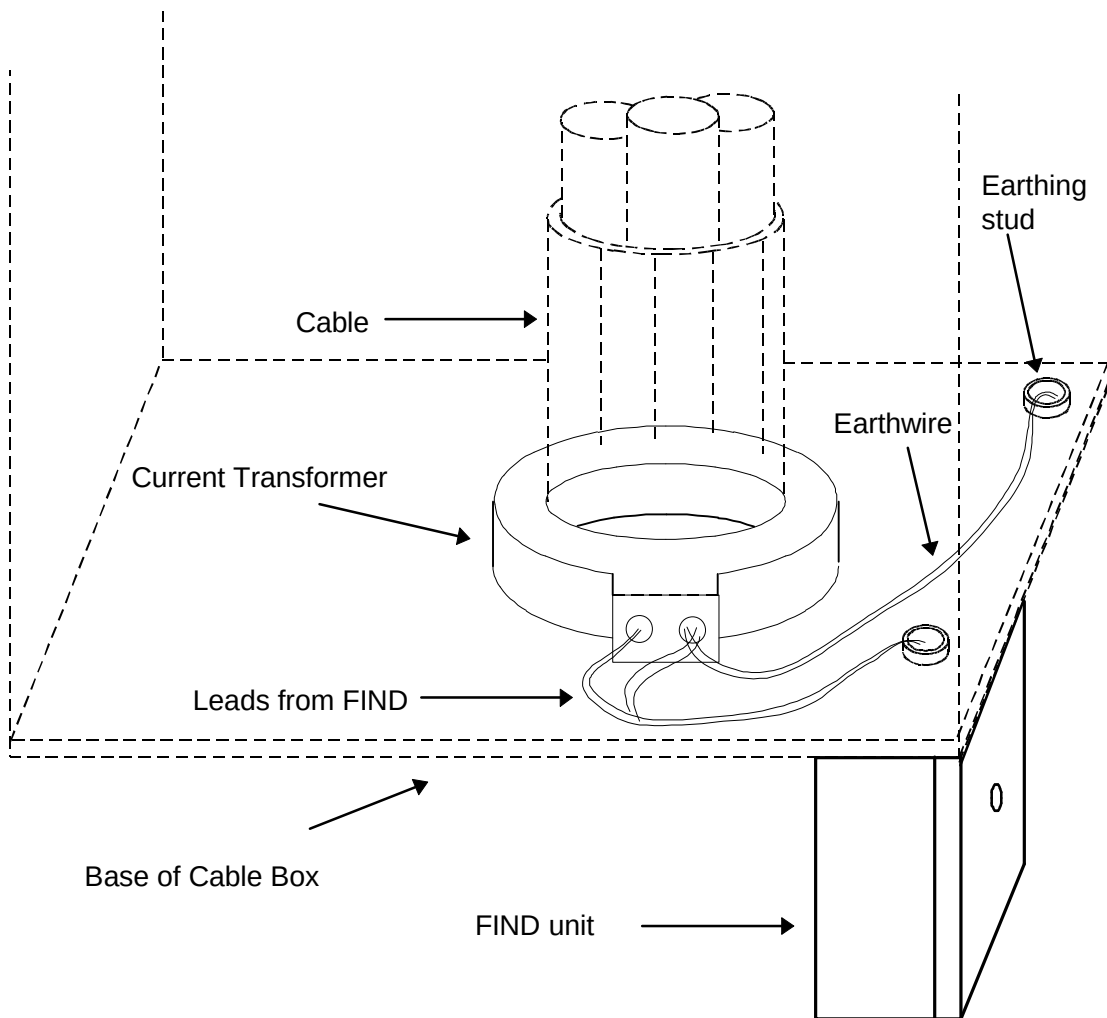
Screw the spigot projecting above the FIND into one of the earthing studs on the base of the cable box such that the FIND projects below the box and faces the required direction. The FIND may be left or right mounted according to site conditions.

Connect the leads from the FIND to the CT. Ensure the earthwire is connected to another earthing stud.

Use the clips provided to secure spare leads.

Connections are as follows: (left to right viewed from the rear of the FIND below the battery)

- Alarm Normally open
- Alarm Normally closed
- Alarm Common
- Current Transformer
- Current Transformer
- Reset
- Reset



5.4 Installation of Split Core Current Transformer

1. Place jubilee clip around cable.
2. Remove nut, bolt and washers from lower circlip and take out bottom half of split core.
3. Check that the faces of the exposed core are clean and free of dust or dirt.
4. Remove L-brackets from top half of split core, rotate 180 degrees and replace (loosely) so that the ears protrude from the split core.
5. Place top half assembly around the cable sliding the L-bracket between the cable and jubilee clip.
6. Adjust L-brackets until assembly feels firm on cable and tighten bolts accordingly.
7. Offer up bottom half of split core squarely to ensure core face alignment, making sure that the protective weatherproof gasket is not caught between them.
8. Once both halves are aligned fit nut, bolt and washers to outer circlip and tighten gently until resistance is felt and core faces are firmly met. Do NOT over-tighten.

6. ORDERING INFORMATION

When ordering please specify the features required, the following options are available:

- 3 hour timed reset
- 24 hour timed reset
- DC voltage reset (12-48V dc for 500ms)
- AC voltage reset (50-240V ac for 10 seconds)
- 20mm glanded cable entry (pre-drilled)
- Directly mounted on 60/1 solid core CT
- Directly mounted on 60/1 split core CT
- Supplied with solid core internal CT and fixing kit